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Teaching English with Science: A Result of Content and Language Integrated Learning Approach and Mobile-assisted Inquiry Pedagogy

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Abstract: To improve meaningful learning for today's students, Content and Language Integrated Learning (CLIL) approach has been adopted to design positive learning environments in which both content and foreign language can be taught and learned together. This study presents an examination of students' learning motivations, and their perceptions toward the teaching English with Science in Content and Language Integrated Learning (CLIL) approach and Mobile-assisted Inquiry pedagogy through pre-test and post-test design. The study was conducted with 20 eighth grade students in northeastern region of Thailand. They were recruited to participate in the teaching English with Science in Content and Language Integrated Learning (CLIL) approach and Mobile-assisted Inquiry pedagogy. Students were examined their learning motivations and perceptions using 25 and 21 items of 5-points Likert-scales questionnaires. The results revealed that the students increased their learning motivations and perceptions toward the teaching English with Science in Content and Language Integrated Learning (CLIL) approach and Mobile-assisted Inquiry pedagogy. This finding implied that the teaching English with Science toward Content and Language Integrated Learning (CLIL) approach and Mobile-assisted Inquiry pedagogy had an influence on students' learning motivations and their perceptions. This finding suggest that teaching English with Science in Content and Language Integrated Learning (CLIL) approach and Mobile-assisted Inquiry pedagogy could be a promising way of enhancing secondary school students' learning motivations and their perceptions in English with Science class.

Keywords: Teaching English with Science, Content and Language Integrated Learning (CLIL), Mobile Technology Inquiry Based Learning

1. Introduction

With the globalization of an English language as a communication tool and the use of technology is increasing, the characteristics of the learners and teachers are changing. The part of English language teaching in the classroom is changed, the role of teaching is not only focused on the language itself but the teachers should apply English language with the content subjects. To this view, it is called "Content and Language Integrated Learning" (CLIL) approach which widely advertised as a "dual-focused approach" that gives equal attention to language and content (e.g., Mehisto, Marsh, and Frigols, 2008, p.9), CLIL can be described as an educational approach where curricular content is taught through the medium of a foreign language (Dalton-Puffer, 2011). In addition, CLIL as a solution for improving the effectiveness of language learning as well as students' motivation (Scott & Beadle, 2014).

The first CLIL English class in Thailand was occurred in 2006, the cooperation between the Thai Ministry of Education and the British Council in attempting to enhance Thai educational outcomes (MacKenzie, 2008). The first CLIL project showed that the CLIL approach was beneficial for language learning in the Thai context. The students' English skills were improve in this project, and they had positive attitudes toward learning language. Therefore the main part of the teacher in the CLIL classroom was a facilitator who help the students learning both individual and group learning processes to acquire knowledge, potential of perception, communication, and reasoning would be shown to work effectively in CLIL English classroom for Thai students (Dalton-Puffer, 2011).

Recently, mobile devices such as smartphones and tablets PC were changing how teachers teach and students learn. Mobile devices are recognized as an emerging technology with the potential to facilitate teaching and learning strategies (Jeng, Wu, Huang, Tan, & Yang, 2010). In addition, Hwang, Wu, and Ke (2011) reported that the use of an interactive concepts map with mobile learning can promote learning attitude and achievement for students. Furthermore, Hwang and Chang (2011) suggested that integration of mobile devices into learning environments can encourage students' learning interest and their motivation. Moreover, Panjaburee and Srisawasdi (2018) mentioned that the dynamic growth of mobile technology and the spread of the internet, there have created numerous new opportunities for the education in the next decades. To improve the quality of education in developing countries such as Thailand, new tools must be used both in terms of pedagogical methodology and technical devices. Additionally, mobile-assisted inquiry pedagogy were apply in KKU Smart Learning Academy Project, a project that initiated by Khon Kaen University since 2016 to develop knowledge and understanding for students in the three subject fundamentals: Science, Mathematics, and English, basically promote skills by KKU smart learning innovation, media skills, develop skill of information and technology and life skills and profession skills. Thus, to improve meaningful learning for students, the purpose of this study was examining students' learning motivations and their perceptions toward the teaching English with Science in Content and Language Integrated Learning (CLIL) approach and Mobile-assisted Inquiry pedagogy.

2. Literature Review

2.1 Content and Language Integrated Learning (CLIL)

The rapid changes and increases complexity of today's world present new challenges and put new demands on our education system. The role of English language teaching in the classroom is changed, the language may not directly taught but it may be taught English in learning content. At the present, Content and Language Integrated Learning (CLIL) approach is a worldwide increasing phenomenon. During the last decade it had speedily growth especially throughout Europe and Asia, where it was often being established as a special educational approach (Coyle et al., 2010; Yang, 2014). CLIL is a dual-focused approach which additional language is used for the learning and teaching of both content and language (Coyle, Hood, & Marsh, 2010, p.1; Marsh, 2012). In addition, CLIL is a content-driven because it implicated learning content through an additional language (Coyle et al.,2010; Dalton-Puffer & Smit, 2007; Eurydice, 2006) that also associated to culture, environment, and learning (Dalton-Puffer, 2011; Jappinen, 2005) based on connected pedagogies and using contextual methodologies (Coyle et al., 2010). Furthermore, the term of CLIL included a lot of educational approaches of bilingual education and CLIL programs vary as much as European sociolinguistic and socio-educational contexts did. The purpose of teaching and learning process were not only on language but also on content.

Additionally, history and science were two of the subjects which may cause most concern or lack of interest in students in CLIL programs. Essentially, this was due to the amount of contents and the comprehension of chronological events or scientific principles and formulas in a language which differed from the mother tongue. In science content relation, it was essential to take an interest in the areas of "biology, mathematics, Earth's science, physics, astronomy and chemistry" (Linares, 2016, p. 24) are consisted in one subject. Likewise, the subjects in which CLIL is utilized vary across the different situations, but the social studies (e.g. politics, history, and geography) dominate the landscape of bilingual instruction due to historical reasons. It should be examined that a recent trend towards the natural sciences and math in bilingual programs is slowly improvement. In the same way, Science provision through Content and Language Integrated Learning (CLIL) is still rather low. This study, we implemented a newly developed the integration of language and content in scientific English classroom towards Content and Language Integrated Learning (CLIL) approach enhancing both students' learning motivations and students' perceptions.

2.2 Mobile Technology Inquiry Based Learning

At the present time, digital technologies and learning resources have important roles in education, students are digital natives because they have grown up with technologies; it woven into their lives. Mobile devices such as smartphones and tablets PC became more accessible and affordable, mobile devices had become a learning tools with great potential in both classrooms and outdoor learnings. Regarding, Lai and Hwang (2015)'s idea, the blended mobile learning model is used to bridge the traditional, in-class, and outdoor instruction through a set of effective and possible teaching strategies related to mobile and ubiquitous learning, where the two mobile learning modes help learners to connect the content of their textbooks or what they have learned in the traditional instruction to the digital resources and real-world learning targets. Therefore, there are pedagogical possibilities to transform traditional or conventional instruction into innovative and creative learning environment with the technological affordances of mobile technology with regarding particular context of school classes or courses. In particular, research and development on the possible uses and potentialities of mobile technologies were continuously growing in developed countries and some of developing countries, but in Thailand, the implementation of technologies as a pedagogical tool to support inquiry-based learning science was still limited, terms of curriculum coverage and alignment in national curriculum (Srisawasdi, 2015). So that it can bring some challenges to overwhelm the limited practice of mobile and ubiquitous learning in Thailand, a developing country, but the same time it can bring some opportunities too.

Over recent years, the amount of studied about mobile technology have been increased. Many mobile devices were used in-class and outdoor instruction for enhance students' learning and their effect related to attitude and affective goals in different environments. Most of the findings of the studies pointed the added mobile learning is promoting students' affective (e.g. interest, attitudes) and cognitive domain. The findings from the inquiry-based learning with mobility (FILM), comparing the results with hands-on inquiry-based learning (HIL) and traditional learning (TL) showed that better outcomes were achieved and help students to comprehend conceptual understanding about liquid pressure both observable and unobservable level of phenomena (Chaipidech & Srisawasdi, 2017). In addition, Kamalawardhana & Panjaburee (2018) also mentioned the fact that students' perceptions towards the digital game were not influenced by the students' gender and learning style, and their gender learning styles were not significant different with the average of the learning interest levels according to the science learning with the digital game. Furthermore, the study of Answer me for learning: Development of ubiquitous learning system for conducting context-aware learning experience (Meuansechai, Feungchan, & Srisawasdi, 2015; Srisawasdi et al., 2016) showed a positive effect on the improvement of conceptual learning outcomes on sound wave phenomena and also promoting better science motivation. These positive outcomes could be improving students' attitude and enhancing students' conceptual learning with mobile-assisted inquiry pedagogy.

3. Methods

In this study, the researchers conducted an examination students' learning motivations and their perceptions toward teaching English with Science in Content and Language Integrated Learning (CLIL) approach and Mobile-assisted Inquiry pedagogy. The findings of the examination provided us as a basis in order to design a novel learning experience for teaching English with Science.

3.1 Participants

The participants of this study were 20 students who are studying in eighth grade and range of age is between 14 and 15 years in a public school located in northeast region of Thailand. They have no experience yet in learning English with Science toward Content and Language Integrated Learning approach and Mobile-assisted Inquiry pedagogy. In addition, they were taught on the concepts of respiratory system in regular science class before participating in this study.

3.2 Research Instruments

This study used two instruments for determining students' learning motivations and their perceptions toward teaching English with Science in Content and Language Integrated Learning (CLIL) approach

and Mobile-assisted Inquiry pedagogy and questionnaires were administered in pre-test/post-test design. First, the students' motivation questionnaire was developed form Science Motivation Questionnaire consisting of 25 items. This instrument was a Likert-scale putting items with five motivation components, including Intrinsic Motivation (IM) consisting of five items, Career Motivation (CM) consisting of five items, Self-determination (SD) consisting of five items, Self-efficacy (SE) consisting of five items and Grade Motivation (GM) consisting of five items (Glynn et al., 2011). Students answered the questionnaire to each item on a five-point-scales of ranging from "never" (1 point) to "always" (5 point). Second, the students' perception questionnaire consisting of 21 items of 5 points rating scale (Peng et al., 2009) that focusing on two perceptual constructs consisting; (i)learning experience (12 items) and (ii) overall impression (9 items), with a perfect score of 60 and 45 points respectively. For each item, respondents were assigned to rate how much the respondent agree of five scales, from 1-strongly disagree to 5-strongly agree.

3.3 Learning Materials

In this study, technology materials which bring to support learning process are interactive video from Lifesaver application, digital tools for science from iStyle Science Note Science Note application, and interactive presentation from Nearpod application. Students could also use all applications on their mobile devices. First, interactive video from Lifesaver application came with a movie that students could play like a game, it took students into situation where people were choking and students had to make the right choices to save people life. Students learned by doing activities: Did it wrong, and saw the consequences or did it right, and sensed the thrill of saving life. Second, digital tool for science from iStyle Science Note application is used as a digital tool for practitioners to learn and reflect fully the integrated (Integrated STEM Education) through context by focusing on the ability to create a scientific explanation. Students answered an inquiry questions through iStyle Science Note application by using CER methods: claim, evidence and reasoning. Students made their claims in the beginning. Next, students provided evidences supporting their claims. Then students explained how the evidences answering the questions or solving the problems. Third, Nearpod application was an interactive classroom tool that enabling teachers to create engaging learning experiences by providing interactive presentations, collaboration, and real-time assessment tools into one integrated solution. Including interactive features such as quizzes, open-ended questions, videos, polls, and drawing tools. Students joined respiratory system drawing activity through Nearpod application. Then students shared each of the students' drawing to the rest of the class and discussed together.

Figure 1. Illustrate of learning materials: Lifesaver, iStyle Science Note, and Nearpod application (Left to right).

3.4 An example of Teaching English with Science: A Result of Content and Language Integrated Learning Approach and Mobile-assisted Inquiry Pedagogy on respiratory system

In presentation, teacher oriented respiratory system concepts and provided interactive video from Lifesaver application about people were choking situation and then students watched video and made the right choices to save people life and recognized the choking first aid knowledge. For practicing, teacher introduced inquiry questions of respiratory system on iStyle Science Note application to the students. Then students answered an inquiry questions by using CER methods: claim, evidence and reasoning. First, students made their claims. Next, students provided evidences supporting their claims. Finally, students explained their reasoning. Classroom assessment, teacher asked students summarizing

the concepts of respiratory system through Nearpod application by drawing and labeling the organs of respiratory system and shared each of the students' drawing to the rest of the class. Finally, teacher discussed with the students about respiratory system and tried to connect the content to choking situation interactive video.

3.5 Data Collection and Analysis

The students were given 15 minutes to fill out questionnaires on students' learning motivations and their perceptions to determining their attitude toward teaching English with Science in Content and Language Integrated Learning (CLIL) approach and Mobile-assisted Inquiry pedagogy. After completing the instruments, they were explored to interact with the assigned of teaching English with Science in Content and Language Integrated Learning (CLIL) approach and Mobile-assisted Inquiry pedagogy. After finishing the learning process, students were administered by the same questionnaires again for 15 minutes to determining their pedagogy attitude. Before interaction with teaching English with Science in Content and Language Integrated Learning (CLIL) approach and Mobile-assisted Inquiry pedagogy, teacher provided an introduction of respiratory system concepts and learning process toward Content and Language Integrated Learning approach and Mobile-assisted Inquiry pedagogy.

Figure 2. Illustrate of Teaching English with Science: A Result of Content and Language Integrated Learning approach and Mobile-assisted Inquiry pedagogy on respiratory system.

The statistical data techniques selected for analyzing students' motivations and perceptions were performed by repeated measure MANOVA in IBM SPSS 19.0 to compare the effect of teaching English with Science in Content and Language Integrated Learning (CLIL) approach and Mobile-assisted Inquiry pedagogy.

4. Results and discussion

4.1 Effect of Teaching English with Science: A Result of Content and Language Integrated Learning Approach and Mobile-assisted Inquiry Pedagogy on students' science motivations

The results for the repeated measures MANOVA from pre- to post- questionnaires were conducted to determine students' learning motivation scores on the five subscales. In Table 1, the repeated measures MANOVA indicted a significant main effect for time (Wilks' lamda = .287, $F_{(1,14)} = 4.977$, p = .015, partial $\eta^2 = .713$). Regarding the repeated measures MANOVA analysis of students' learning motivation scores on the five subscales, Intrinsic Motivation (IM), Career Motivation (CM), Self-determination (SD), Self-efficacy (SE), Grade Motivation (GM), all five motivation scales positively related together. These results indicated that students have increased their positive motivations towards teaching English with Science in Content and Language Integrated Learning (CLIL) approach and Mobile-assisted Inquiry pedagogy.

Table 1

Description statistics, means and standard deviations for Teaching English with Science: A Result of Content and Language Integrated Learning Approach and Mobile-assisted Inquiry Pedagogy on students' science motivations

Subscale	Pre-test Mean (SD)	Post-test Mean (SD)	F	Sig.	η^2
Intrinsic Motivation (IM)	16.15 (4.21)	20.75 (3.08)	14.588	.002*	.510
Career Motivation (CM)	15.65 (4.11)	20.30 (3.25)	12.305	.003*	.468
Self-determination (SD)	15.35 (3.98)	19.10 (3.48)	10.494	.006*	.428
Self-efficacy (SE)	15.15 (2.94)	18.75 (2.83)	20.128	.001*	.590
Grade Motivation (GM)	16.50 (5.78)	20.55 (3.98)	13.512	.002*	.491

*p < .05

The finding from this result indicated that students have increased their positive learning motivations toward teaching English with Science in Content and Language Integrated Learning (CLIL) approach and Mobile-assisted Inquiry pedagogy. For example, students learned by doing activities through interactive video from Lifesaver application. Students watched and interacted with the video. It took students into the real chocking situation that students made the crucial decisions and learned the essential skills needed to save a life within time limits. Students are motivated to learn when they could use mobile devices in learning. Students have increased their positive learning motivations when they encountered the challenging situations with an enjoyable and comfortable learning environment via mobile devices. It implied that teaching English with Scientific Inquiry in Content and Language Integrated Learning (CLIL) approach toward mobile technologies had an influence on students' learning motivations.

4.2 Effect of Teaching English with Science: A Result of Content and Language Integrated Learning Approach and Mobile-assisted Inquiry Pedagogy on students' perceptions

The results for the repeated measures MANOVA pre- to post- questionnaires were conducted to determine students' perception scores on the two subscales. In Table 2, the repeated measures MANOVA indicted a significant main effect for time (Wilks' lamda = .316, $F_{(1,17)} = 17.333$, p = .000, partial $\eta^2 = .684$). According to the repeated measures MANOVA analysis of students' perception scores on the two subscales, Experience and Impression, all two perception scales positively related together. These results indicated that students increased their positive perceptions toward teaching English with Science in Content and Language Integrated Learning (CLIL) approach via Mobile-assisted Inquiry pedagogy.

Table 2

Description statistics, means and standard deviations for Teaching English with Science: A Result of Content and Language Integrated Learning Approach and Mobile-assisted Inquiry Pedagogy on student's perceptions

Subscale	Pre-test Mean (SD)	Post-test Mean (SD)	F	Sig.	η^2
Experience	29.05 (10.08)	43.50 (6.61)	28.534	.000*	.627
Impression	24.00 (8.35)	33.40 (5.29)	24.29	.000*	.589

*p < .05

The finding from this result indicated that students have increased their positive perceptions toward teaching English with Science in Content and Language Integrated Learning (CLIL) approach and Mobile-assisted Inquiry pedagogy. For example, students interacted with inquiry activities via mobile devices through iStyle Science Note application. Students gathered evidences and explained how the evidences supporting their claims by giving logical reasoning answers. The ways of learning have encouraged the way of students perceiving the information. It implied that teaching English with

Scientific context toward Content and Language Integrated Learning approach and Mobile-assisted Inquiry pedagogy had an effect on students' perceptions.

The analysis from Wilks' lamda test revealed students' learning motivations toward Teaching English with Science in a result of Content and Language Integrated Learning approach and Mobile-Assisted Inquiry pedagogy had post-test scores greater than pre-test scores (Wilks' lamda = .287, $F_{(1,14)} = 4.977$, $p = .015$, partial $\eta 2 = .713$, $p < .05$). This evidence indicated that it was significant difference between the pre-test and post-test on student's learning motivations toward teaching English with Science in a result of Content and Language Integrated Learning approach and Mobile-Assisted Inquiry pedagogy. In addition, students' perceptions toward teaching English with Science in a result of Content and Language Integrated Learning approach and Mobile-Assisted Inquiry pedagogy had post-test scores greater than pre-test scores also (Wilks' lamda = .316, $F_{(1,17)} = 17.333$, $p = .000$, partial $\eta 2 = .684$, $p < .05$). This result indicated that it was significant difference between the pre-test and post-test on student's perceptions toward the teaching English with Science in a result of Content and Language Integrated Learning approach and Mobile-Assisted Inquiry pedagogy. These mean that when teaching English with Science toward Content and Language Integrated Learning approach and Mobile-Assisted Inquiry pedagogy in respiratory system, there had been a significant impact on students' learning motivations and their perceptions. Regarding the basis of prior research, Merzlykin, Yu, Topolova, and Tron (2018) concluded that using of both AR and CLIL in cloud-based science learning environment helped to develop language and research competencies and to remain motivated in learning Science and English. Therefore CLIL could develop a positive attitude to learning by means of diverse educational activities. Similarly, Garcia and Jurado (2019) mentioned that the students had more motivation when learning history and science subjects within the CLIL (Content and Language Integrated Learning) approach if videos are used, by creating a relaxing and comfortable environment in bilingual educational settings. The use of video was capable of increasing students' interest in the subject and in aiding learning, both of which are important factors in determining motivations, not only CLIL approach could impact on students' motivations but also technology used in the classroom. Furthermore, the students' perceptions of foreign language improvement in their CLIL class was in line with another study language improvement; Lasagabaster and Doiz (2015) pointed out the students' perceptions of language improvement, all age groups acknowledge the improvement of their language proficiency in English because of the CLIL courses when compared to their regular English class. In this study, the significant differences are observed in students' learning motivations and their perceptions toward teaching English with Science in a result of Content and Language Integrated Learning approach and Mobile-Assisted Inquiry pedagogy in pre-test and post-test design. The students' motivations and perceptions were significantly higher scores in all subscales when teaching English with Science in a result of Content and Language Integrated Learning approach and Mobile-Assisted Inquiry pedagogy was followed. Content and Language Integrated Learning approach and Mobile-Assisted Inquiry pedagogy were effective students' learning motivations and their perceptions for the teaching English in Science subject indirectly channels to a target language by means of diverse and challenging educational activities to creating a relaxing and comfortable environment classroom.

5. Conclusion and Future Study

This study reported an impact of Teaching English with Science: A Result of Content and Language Integrated Learning approach and Mobile-assisted Inquiry pedagogy on public school students' learning motivations and their perceptions. The finding revealed successful of increasing all subscales of students' learning motivations and their perceptions toward teaching English with Science in Content and Language Integrated Learning (CLIL) approach and Mobile-assisted Inquiry pedagogy. It implied that teaching English with Scientific Inquiry in Content and Language Integrated Learning (CLIL) approach toward mobile technologies had an effect on students' attitude domains. According to the preliminary findings, students' cognitive domains toward teaching English with Scientific context toward Content and Language Integrated Learning approach and Mobile-assisted Inquiry pedagogy will be carry out in future research.

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